



## SPECIFICATION

### TITLE

"AN ELASTOMER HANGER FOR AN ELASTOMER SUSPENSION"

### BACKGROUND OF THE INVENTION

The present invention is directed to a hanger for a suspension arrangement utilizing the hanger, which hanger has vibration dampening properties.

When mounting a power unit on a vehicle chassis, mounts having elastomer material have been used. For example, see U.S. Patent No. 4,471,935, whose disclosure is incorporated herein by reference thereto. In suspending a vehicle exhaust system from the frame of the vehicle, various hanger arrangements have been suggested. For example, a one-piece elastic support is suggested by U.S. Patent No. 4,380,324, whose disclosure is incorporated herein by reference thereto. Another example of a resilient hanger structure is disclosed in U.S. Patent No. 4,817,909 and U.S. Patent No. 6,070,849, whose disclosures are incorporated herein by reference thereto, along with European Patent Specification 0 320 088 B1 and European Patent 0 529 250 B1. The hanger arrangement in each of these patent documents provide various hanger structures which are designed to have the desired amount of deflection and absorption and/or isolation of vibration between an exhaust system and a chassis of a motor vehicle.

It is desirable to form a hanger for an exhaust suspension which avoids complicated assembly processes, has good absorbance characteristics and enables utilizing the materials that would reduce the cost.

### SUMMARY OF THE INVENTION

To obtain a hanger for an exhaust suspension which has reduced cost, a good absorption characteristic with regard to stiffness and avoids complicated assembly processes, an embodiment is a hanger comprising a first ring portion of an elastomer material having a central opening or aperture for receiving a fastening element, a mass dampener structure having a dampener mass with a central passage; an elastomer spring being disposed in the

central passage, said spring having means for connecting the mass dampener structure to a member and having at least one axial opening for adjusting the resilience of the spring, and means for resiliently connecting the mass dampener structure to the first ring portion, the means being connected to the mass dampener structure to form a serial connection with the elastomer spring.

In the illustrated embodiment, the dampener mass with the central or center passage is formed by a metal ring, preferably a steel ring. The means for resiliently connecting the mass dampener structure to the first ring portion are preferably a pair of elastomer arms which are connected on opposite sides of the mass dampener structure and are integrally formed with the ring portion. These arms are preferably vulcanized to the mass dampener structure and, as illustrated, are integral with a covering vulcanized or bonded on the metal ring forming the dampener mass and integrally formed with the elastomer spring, which is a sleeve-like element disposed in the center passage of the metal ring forming the dampener mass. In the preferred embodiments, the material of the elastomer sleeve or spring element, the covering and the arms, as well as the first ring portion are the same and preferably a peroxide-molded ethylene-propylene-diene-monomer.

When the hanger is used in an elastomer exhaust suspension, the suspension includes a mounting member for attachment to a vehicle frame and the means for connecting the mass dampener structure to a member includes a connecting pin, which will be attached to a portion of the exhaust system, such as an exhaust pipe, and is received in an axially-extending opening of the sleeve portion forming the elastomer spring with a fit which is soft enough to enable insertion by a hand but is tight enough to prevent or limit relative movement between the surface of the pin and the inner surface of the opening in the elastomer spring. It is also possible that the pin is bonded in the sleeve portion forming the elastomer spring and that the sleeve portion and pin are inserted in the passage of the metal ring forming the dampener mass with a fit which is also soft enough to allow insertion by hand, but tight enough to prevent rotation between the outer surface of the sleeve portion and the inner surface of the passage.

Regardless of whether the sleeve portion forming the elastomer spring is integrally formed with the covering and arms or is a separate element, the stiffness is larger than the total stiffness of the hanger structure. In other words, the spring element or sleeve is the stiffest portion of the hanger.

Other advantages and features of the invention will be readily apparent from the following description, the claims and drawings.

### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of an elastomer exhaust suspension in accordance with the present invention;

Fig. 2 is a front elevational view of the elastomer exhaust suspension of Fig. 1;

Fig. 3 is a side view taken from the right side of Fig. 2;

Fig. 4 is an end view taken from the bottom of Fig. 2; and

Fig. 5 is a cross-sectional view with portions in elevation taken along the lines V-V of Fig. 2 with a pin, a portion of an exhaust system and a portion of a vehicle frame.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

The principles of the present invention are particularly useful in a hanger assembly, generally indicated at 10 in Fig. 1. The hanger assembly includes a metal support or mounting member 11 for the elastomer hanging structure 20, which structure includes a mass dampener structure 30. The hanger structure has, at an upper part, a small, substantially ring-shaped portion 22 with an aperture 24, as best shown in Fig. 5. A rivet 12 passes through the aperture 24 to mount the hanger structure 20 in a metal support or bracket 11, which can be mounted on the vehicle frame structure 61 by fasteners or bolts 62 extending through an aperture 13. The hanger structure 20 also has a pair of arms 26, which are integral with the ring-shaped portion 22 and are connected to the mass dampener structure 30 at connecting points 28 on opposite sides of the structure 30, which has a ring shape. As illustrated in Figs. 1 and 2, the arms 26 have a curved shape and space the structure 30 from

the ring portion 22. The arms 26 form spring elements which form a means for resiliently connecting the mass dampener structure to the first ring portion 22.

The mass dampener structure 30 includes a dampener mass 31 which, as shown in Figs. 2 and 5, has a central passage, aperture or opening 32. The dampener mass 31 is formed by a metal ring, which is preferably a steel ring. The mass or ring 31 has a covering 33 which is vulcanized onto the dampener mass 31 and which has a sleeve portion 34 filling the aperture or central opening 32 of the ring-shaped dampener mass 31. This sleeve portion 34 acts as an elastic spring element of the mass dampener structure 30. To adjust the elastomer spring 34, two axial openings or apertures 36, which are an upper and lower aperture, are provided around the aperture 38 of the sleeve portion 34.

The hanger 20 has means for connecting the hanger to a member, such as an exhaust pipe 60 of an exhaust system (see Fig. 5). This means is illustrated as a sleeve portion 34 receiving a pin 50. The elastomer spring element or sleeve 34 is radially pre-biased so that the pin 50 cannot move relative to the sleeve 34. Thus, the spring element 34 has a pre-bias to form a fit soft enough to enable assembly of the pin by hand in the aperture 38, but firm enough to prevent any sliding movement between the surface of the pin and the inner surface of the aperture 38. To facilitate this, the pin preferably is provided with a conical head at one end and a washer-like shoulder 54 spaced inward from the head and integral with the pin. As illustrated, the other end of the pin is connected to the exhaust pipe 60. As mentioned hereinabove, the means for connecting could also have the sleeve 34 bonded onto the pin; in which case, the pin would not need the head 52 and the washer-like shoulder 54 and then the pin with the sleeve 34 could be inserted into the aperture or central passage 32. Again, the sleeve would be designed to provide a fit which is soft enough to allow assembly by hand, but firm enough to prevent relative movement of the outer surface of the sleeve with the inner surface of the opening 32.

As mentioned above, the arrangement of the arms and the sleeve shows that the metal ring forming the dampener mass 31 is in series with the spring formed by the sleeve 34 and the spring-like elements of the arms 26.

As illustrated in Figs. 1-4, the structure 30 has indents or recesses, such as 40. The hanger 20 has ribs, such as 29, adjacent the connection of each of the arms 26 to the ring portion 22 and ribs 41 on the outer surface of the arms. These ribs or projections are part of the production feature. It is also noted that the elastic portion or ring 22, the arms 26 as well as the covering 33 having the sleeve portion 34 can be integrally formed of the same elastomer.

The elastomer exhaust suspension has the advantage of a reduced transferal or amplification reaction of oscillations and, thus, a reduced transmission of noise from the exhaust pipe 60 to the vehicle structure, such as 61, of the car body. To achieve a good absorbance characteristic, the stiffness of the spring element 34 of the dampener structure 30 has to be clearly larger than the stiffness of the remaining portion of the hanger structure 20. In particular, this stiffness relationship ensures that also higher frequencies can be absorbed by a relatively soft suspension in a cold state as well as in a warm state.

Another advantage of this type of serial connection of the suspension means is the tunability of its absorbency on its geometric form, in particular to achieve the stiffness relationship, even with one and the same material, which facilitates an adaptation to different loads. The serial connection of the hanger 20 and the elastomer spring 34 via the arms 26 simplifies the exhaust suspension structure and reduces the cost. The absorbance characteristics of peroxide molded EPDM (Ethylene-Propylene-Diene-Monomer) compositions are sufficient for usage with the exhaust suspension system of the invention. This material choice leads to a greater cost reduction compared to the normally-used material VMQ (Methyl-Vinyl-Silicone Rubber).

Although various minor modifications may be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent granted hereon all such modifications as reasonably and properly come within the scope of our contribution to the art.